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Patent
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	)	
	)	
Kjell GUSTAFSSON et al.	)	Group Art Unit: 2682
	)	
Application No.: 09/348,494	)	Examiner: Nghi H. Ly
	)	
Filed: July 7, 1999	)	Appeal No.
	)	
For: CONTROLLED ANTENNA DIVERSITY	)	

BRIEF FOR APPELLANT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

This appeal is from the decision of the Primary Examiner dated May 8, 2002 (Paper No. 10), finally rejecting claims 1, 2, 6-13 and 17-20, which are reproduced as an Appendix to this brief.

A check covering the [ ] $160.00 (2402) [X] $320.00 (1402) Government fee and two extra copies of this brief are being filed herewith.

The Commissioner is hereby authorized to charge any appropriate fees under 37 C.F.R. §§1.16, 1.17, and 1.21 that may be required by this paper, and to credit any overpayment, to Deposit Account No. 02-4800. This paper is submitted in triplicate.

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I. Real Party in Interest

The present application is assigned to Telefonaktiebolaget LM Ericsson, as recorded at Reel/Frame 010096/0044 in the assignment records of the U.S. Patent and Trademark Office.

II. Related Appeals and Interferences

Neither the Appellants, the Appellants' legal representative, nor the assignee, knows of any other appeal or interferences which will affect or be directly affected by or have bearing on the Board's decision in the pending appeal.

III. Status of Claims

Claims 1-20 are pending. Claims 3-5 and 14-16 have been allowed. Claims 1, 2, 6-13, and 17-20 stand finally rejected and are appealed.

IV. Status of Amendments

No amendments have been filed subsequent to the final rejection.

V. Summary of the Invention

The present invention involves a method for a controlling antenna diversity.[1] (p.1, lines 4-6.) Antenna diversity is advantageous to counteract the common problem of radio communication systems of the loss of information in the uplink and downlink signals resulting from multipath fading. (p. 2, lines 3-5.) Multipath fading occurs when a transmitted signal travels along several paths between a transmitting station and its intended receiver. (p. 2, lines 5-7.)

Fading can be mitigated by using multiple receiver antennas using some form of diversity combining, such as selective combining, equal gain combining or maximal-ratio combining. (p. 2, lines 14-16.) Diversity takes advantage of the difference in fading on

[1] All page number citations in Sections V and VIII are to the specification as originally filed.

different antennas, so that when one antenna has a faded signal, chances are the other antenna does not. (p. 2, lines 16-18.) Other factors which degrade reception include interference. (p. 2, lines 22-28.) Having multiple antennas, and processing the received information accordingly, helps combat fading and makes the communication link more robust. (p. 3, lines 9-10.) However, the price of introducing antenna diversity with the extra radio and base band processing, this additional processing requiring additional space, manufacturing costs and power consumption. (p. 3, lines 9-12.)

It has been observed that antenna diversity may not be needed in some situations, such as in radio environments which allow perfectly adequate performance without diversity. (p. 5, lines 21-23.) Hence, antenna diversity can end up spending power on the diversity processing whether it is necessary or not. (p. 5, lines 23-25.) This results in shorter operating time for the battery. (p. 5, lines 25-27.)

In light of these factors, the present invention mitigates the power penalty of introducing diversity in a mobile station by using the diversity branch only when needed. Stated differently, the diversity branch can be controlled (e.g., switched on or off) by the base band processing circuitry where it is decided that the performance gain from using diversity outweighs the extra power consumption in certain circumstances. (p. 6, lines 4-8.)

VI. The Issues

Whether claims 1, 2, 6-13 and 17-20 are properly rejected under 35 U.S.C. § 103 as allegedly being obvious over the prior art illustrated in Figure 3 of the present application in view of the Conner et al. patent (U.S. Patent No. 6,256,484).

VII. Grouping of Claims

For purposes of this appeal, claims 1, 2, 6-13 and 17-20 stand or fall together insofar as the bright line distinctions between the prior art and the independent claims relied upon below are so clear. The separate patentability of various claims need not be discussed to reach a determination of patentability, and, out of expediency, are not.

However, this should not be viewed as an admission as to the lack of separate patentability; rather, this mechanism is employed out of procedural expediency for purposes of this appeal.

VIII. Argument

Prior Art Figure 3

As disclosed at page 4 in the present application, systems such as the IMT 2000 are defined in a way where diversity is more or less necessary to meet some of the specific performance requirements. (p. 4, lines 17-19.) The overall criteria is to meet some kind of performance measure for the communication link. (p. 4, lines 19-20.) This can be monitored in any one of several ways such as the signal-to-noise ratio of the received signal, estimated or measured bit error rate, or frame error rate, or by keeping track of the number of required re-transmissions where the radio link protocol uses re-transmissions. (p. 4, lines 21-24.) In most cases, both antenna signals need to be fully processed and the process signals combined in the most beneficial manner. (p. 4, lines 24-26.)

Figure 3 of the present application is an example of such a system. In Figure 3, a first antenna 310 receives radio signals and provides its received signals to a first RF processor 330. A second antenna 312 receives radio signals and provides its received signals to a second RF processor 332. The first RF processor 330 processes, e.g., down converts, the received RF signal to an intermediate signal for input to a base band processor 340. The first RF processor 330 also processes signals to be transmitted, including converting the signal to a radio frequency for transmission over the first antenna 330. (p. 5, lines 1-8.)

Simultaneous with the processing of the first RF signal in the first RF processor 330, the second antenna 312 receives the same signal from the same source, but perhaps over a different radio path. This second signal is processed (e.g., down converted) in the second RF processor 332. The second signal is processed in the second signal processor 332 before being forwarded to the base band processor 340. The second RF processor 332 operates only in a receive mode. (p. 5, lines 9-15.)

The need for extra processing when using diversity is particularly true for systems based on CDMA, because in this case the antenna signal has to pass through most of the base band processing before the quality thereof can be judged. Simple measurements like signal strength do not give enough information about one individual user signal. (p. 5, lines 16-20.)

The *Conner et al.* Patent

In the final Office Action, the Examiner characterizes the *Conner et al.* patent as disclosing selectively deactivating "a second radio frequency processing circuit 18A based on a determination as to whether diversity is appropriate (see column 1, line (sic) 50-59)." Applicants respectfully contest this characterization of the *Conner et al.* patent.

The *Conner et al.* patent discloses a system wherein signals from a first antenna 18 and a second antenna 20 are combined at a point 22 when a switch is closed. The first and second antenna are disconnected from each other when the switch is open. What is important to note is that the signals are combined before being received in a RF FM receiver 13. In other words, the *Conner et al.* patent represents a system more akin to Figure 2 of the present application rather than the present invention or the diversity processing shown in Figure 3.

In continuing the rejection, the Examiner states at page 2 of the final Office Action dated May 8, 2002, that because "the opening and closing states of the frequency processing circuit 18a is determined based on the quality of the received signal, the frequency processing circuit 18a must be based on a determination as to whether diversity is appropriate." Applicants respectfully submit that element 18a cannot be accurately described as a frequency processing circuit. As described throughout the *Conner et al.* patent, 18 is described as a "first antenna" (see, e.g., column 3, line 25) and element 18a is not described in the *Conner et al.* specification, but is illustrated as being identical to the first antenna 18 in Figure 2. Antennas receive radio signals, but they do not involve processing and therefore cannot be described as "frequency processing circuits." For this

reason alone, the rejection should be withdrawn. This is not merely a matter of semantics, as illustrated below.

Defective Claim Interpretation

In the Response to Arguments attached to the Advisory Action of July 29, 2002, the Examiner suggests that "antenna 18a in the Conner et al has a function to receive electromagnetic wave [sic] from [sic] the air, convert electromagnetic wave [sic] into electrical RF wave [sic], and couple the converted RF electrical wave to the transceiver circuit. Therefore, the antenna disclosed in Conner et al is a frequency processing circuits [sic]." (Emphasis added) Appellants respectfully submit that the *Conner et al.* antenna cannot be properly characterized as a "frequency processing circuit" in accordance with the present invention, for several reasons.

First, independent apparatus claims 1 and 2 recite a second radio frequency processing circuit which receives and processes signals from a second antenna. The antenna 18A of the *Conner et al.* patent does not meet this recitation. The antenna 18A does not receive and process signals from an antenna that is part of a mobile station. Independent method claim 13 has similar recitations.

It is respectfully submitted that the Examiner's mischaracterization of the prior art as meeting this claim recitation fails to establish a *prima facie* case of obviousness. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson* 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). As such, the Examiner's decision should be reversed. *In re Oetiker*, 977 F.2d 1443,24 USPQ2d 1443 (Fed. Cir. 1992).

Further, the broadest reasonable interpretation of the claims must also be consistent with the interpretation that those skilled in the art would reach. *In re Cortright*, 165 F.2d 1353, 1359, 59 USPQ2d 1464, 1468 (Fed. Cir. 1999). It is respectfully submitted that an antenna would not be confused with a radio frequency processing circuit which receives and processes signals from an antenna in the same mobile station.

Second, independent claims 1, 2 and 13 recite first and second antennas as distinct elements from the radio frequency processing circuit. It would seem inherently unreasonable to interpret the antenna 18A of the *Conner et al.* patent as both the second antenna and the second radio frequency processing circuit, or that the antenna 18A would receive signals from some sort of hybrid between prior art Fig. 3 and the *Conner et al.* patent particularly in light of the totality of the written description. As such, the rejection cannot be sustained. *See In re Baker Hughes, Inc.*, 215 F.3d 1297, 55 USPQ2d 1149 (Fed. Cir. 2000).

Hypothetical Motivation Defective

The stated motivation for the hypothetical modification of Figure 3 to include a switch such as disclosed in the *Conner et al.* patent it is "in order to obtain an inexpensive and simple diversity receiver (as suggested by *Conner* at column 2 lines 43-49)." See Final Office Action at page 4, lines 6-9.

More specifically, the *Conner et al.* patent states that the motivation for its device, as pointed out by the Examiner and mentioned at column 2, lines 43-49, lies in a space diversity receiver system which is "relatively inexpensive and simple in construction". Taking this motivation and the specific teaching of using one RF FM receiver 13 with two antennas 18 and 20, the only modification the *Conner et al.* patent would suggest to prior art Figure 3 of the present application is a modification which would result in something more akin to prior art Figure 2 where there are two antenna and one RF processor. The modification as hypothetically proposed by the Office would be that one antenna, (e.g. antenna 210 of Figure 2) would be permanently connected to the RF processing circuit 230, where as the second antenna 221 would be selectively connected to the same RF processing circuit 230. While the undersigned is not certain that such a hypothetical modification would be possible for the "selection" diversity used in Figure 2, Applicants note that the hypothetical combination ultimately results only in the circuit shown in the *Conner et al.* patent. What the hypothetical combination does not show, teach or suggest is the present invention which provides a control signal to a second radio frequency

processing circuit to selectively activate and deactivate *the second radio frequency processing circuit* based on a determination as to whether diversity is appropriate. The present inventors have gone a way completely contrary to the teaching of the *Conner et al.* patent so far as the present invention involves a second radio frequency processing circuit, which relative to the *Conner et al.* patent would appear to only make it relatively expensive and complicated in construction, rather than achieving the *Conner et al.* goal of making a base diversity receiver system which is "relatively inexpensive and simple in construction."

However, the modification suggested by the Examiner is completely contrary to this motivation. Again, the *Conner et al.* disclosure might suggest modifying the selective diversity of Figure 2 to include a switch between antennas 210 and 212 so that occasionally both antennas are used and a combined signal then processed in the RF processing circuit 230. This would not, however, result in the present invention. To modify Figure 3 to include a switch affecting the second RF processing circuit 332 would lead to a more expensive and complicated diversity receiver, rather than following the teachings identified by the Office of the *Conner et al.* patent. Accordingly, there is no motivation in the applied art, and in fact the *Conner et al.* patent teaches away from modifications which would result in the present invention. *See Gillette Co. v. S.C. Johnson & Son, Inc.*, 919 F.2d 720, 16 USPQ2d 1923 (Fed. Cir. 1990).

For these reasons, Applicants respectfully request that rejection be withdrawn and all the claims passed to issuance.

IX. Conclusion

Having specified the errors in the rejection under 35 U.S.C. §103, identified specific recitations in the rejected claims that are not described in the prior art relied upon in the rejection, and explained how such recitations render the claimed subject unobvious over the prior art in accordance with 37 CFR §1.191, Appellants respectfully request that the Examiner's final rejection be reversed, in accordance with 37 CFR §1.196.

Respectfully submitted,

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APPENDIX A

The Appealed Claims

1. A mobile station comprising:

a first antenna;

a first radio frequency processing circuit receiving and processing signals from said first antenna;

a second antenna;

a second radio frequency processing circuit receiving and processing signals from second antenna; and

a base band processing circuit receiving and combining processed radio frequency signals from said first radio frequency processing circuit and from said second radio frequency processing circuit for diversity, and providing a control signal to said second radio frequency processing circuit to selectively activate and deactivate said second radio frequency processing circuit based on a determination as to whether diversity is appropriate.

2. A mobile station comprising:

a first antenna;

a first radio frequency processing circuit receiving and processing signals from said first antenna;

a second antenna;

a second radio frequency processing circuit receiving and processing signals from second antenna; and

a base band processing circuit receiving processed radio frequency signals from said first radio frequency processing circuit and from said second radio frequency processing circuit for diversity, and providing a control signal to said second radio frequency processing circuit to selectively activate and deactivate said second radio frequency processing circuit based on a determination as to whether diversity is appropriate, wherein said first radio frequency processing circuit also transmits signals from said mobile station.

3. A mobile station comprising:

a first antenna;

a first radio frequency processing circuit receiving and processing signals from said first antenna;

a second antenna;

a second radio frequency processing circuit receiving and processing signals from second antenna; and

a base band processing circuit receiving processed radio frequency signals from said first radio frequency processing circuit and from said second radio frequency processing circuit for diversity, and providing a control signal to said second radio frequency processing circuit to selectively activate and deactivate said second radio frequency processing circuit based on a determination as to whether diversity is appropriate, wherein said control signal generated by said base band processing circuit is controlled by a control signal from a base station with which said mobile station is in communication.

6. A mobile station in accordance with claim 1 wherein said determination as to whether diversity is appropriate is based on a signal quality of a demodulated signal.

7. A mobile station in accordance with claim 1 wherein said determination as to whether diversity is appropriate is based on a level comparison diversity technique.

8. A mobile station in accordance with claim 1 wherein said determination as to whether diversity is appropriate is based on a likelihood comparison technique.

9. A mobile station in accordance with claim 1 wherein said determination as to whether diversity is appropriate is based on a measure of bit error rate of a demodulated signal.

10. A mobile station in accordance with claim 1 wherein said determination as to whether diversity is appropriate is based on a measure of frame error rate of a demodulated signal.

11. A mobile station in accordance with claim 1 wherein said determination as to whether diversity is appropriate is based on a measure of a signal to interference ratio of a demodulated signal.

12. A mobile station in accordance with claim 1 wherein said determination as to whether diversity is appropriate is based on a measure of the number of re-transmissions required.

13. A method of controlling diversity in a mobile station, comprising:

receiving a radio signal on a first antenna;

processing radio signals from said first antenna in a first radio frequency processing circuit;

receiving radio signals in a second antenna;

processing radio signals from the second antenna in a second radio frequency processing circuit;

receiving and combining processed radio frequency signals from said first radio frequency processing circuit and from said second radio frequency processing circuit for diversity in a base band processing circuit;

determining whether diversity is appropriate; and

providing a control signal to said second radio frequency processing circuit to selectively activate and deactivate said second radio frequency processing circuit based on said determination as to whether diversity is appropriate.

17. A method in accordance with claim 13 wherein said determination as to whether diversity is appropriate includes measuring a signal quality of a demodulated signal.

18. A method in accordance with claim 13 wherein said determination as to whether diversity is appropriate includes employing a level comparison diversity technique.

19. A method in accordance with claim 13 wherein said determination as to whether diversity is appropriate includes employing a likelihood comparison technique.

20. A mobile station in accordance with claim 1 wherein said determination as to whether diversity is appropriate is based on a measure of at least one of the group consisting of a bit error rate of a demodulated signal, a frame error rate of a demodulated signal, a signal to interference ratio of a demodulated signal, and the number of re-transmissions required.